3.7 Geology and Seismicity

This section discusses the effects of the proposed Visalia General Plan as they relate to geology, soils, and seismicity. Topography, underlying geologic materials, and surface soils within the Planning Area are described, as are soil-related issues such as erosion. Additionally, earthquake hazards including ground shaking and liquefaction are assessed.

Environmental Setting

PHYSICAL SETTING

Topography and Geography

Visalia is part of the Central Valley province, one of several geomorphic provinces in California. The Central Valley is in a basin bounded by the Sierra Nevada foothills and mountains to the east and the Coast Ranges to the west, and filled with deep layers of sediment from the Sierra Nevada. The Planning Area is basically flat, lying at an elevation of approximately 330 feet above sea level. The St. Johns River flows through the northeastern portion of the Planning Area. The river, as well as smaller streams and canals, form alluvial fans.

Geologic Hazards

Surface soils exhibit various characteristics dependent on location, slope, parent rock, climate, and drainage. According to soil survey information obtained from the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), surface soils in the Planning Area range from fine sandy loam and loam to alkali soils. The most prevalent soils are Nord fine sandy loam (19,201 acres); Grangeville sandy loam, drained (15,709 acres); Tagus loam (12,495 acres); and Akers-Akers, saline-sodic, complex (8,094 acres). Some soils have the potential to present moderate geologic hazards to building, due to their susceptibility to erosion or to expansion and contraction.

Soil Erosion

A soil's "K factor" indicates its inherent susceptibility to erosion by water, without taking into consideration slope or groundcover factors. Values of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to erosion by water. In general, soil containing high amounts of silt can be easily eroded, while sandy soils are less susceptible. Erosion is most likely to occur on sloped areas with exposed soil, especially where unnatural slopes are created by cut-and-fill activities. Soil erosion rates can be higher during the construction phase. Excessive soil erosion can eventually damage building foundations and roadways. Most surface soils in the Planning

Area have moderate potential for erosion by water; in some areas, the erosion potential is considered low to moderate, depending on soil depth.

Expansive Soils

Expansive soils create a shrink-swell hazard. Structural damage may result over a long period of time, usually from inadequate soils and foundation engineering or the placement of structures directly on expansive soils. Expansive soils are largely comprised of clays, which expand in volume when water is absorbed and shrink as the soil dries. Four of the Planning Area's soil types are considered to have a moderate "shrink-swell" potential. These soils underlie about 2,480 acres, and are located on the western edge of the Planning Area near the Highway 99/198 interchange, north of the St. Johns River, and in the northwest near the intersection of Road 80 and Avenue 328.

Table 3.7-1 summarizes Planning Area surface soils by their erosion and shrink-swell potential. **Figure 3.7-1** displays Planning Area soils based on these qualities. As **Figure 3.7-1** shows, Planning Area soils have moderate (61 percent) or low to moderate (39 percent) erosion potential. The great majority (96 percent) of the Planning Area has low potential for expansive soil behavior.

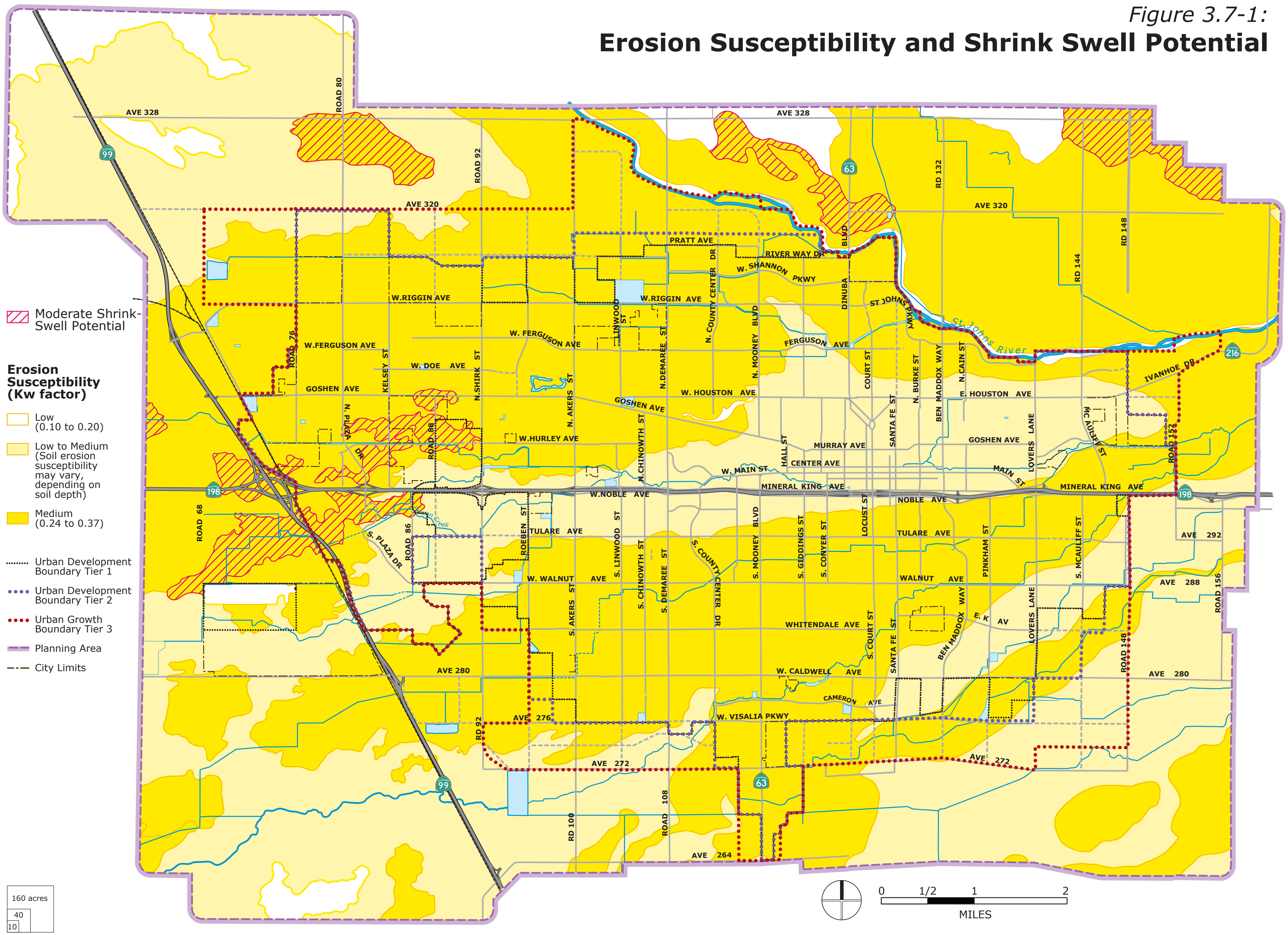
Table 3.7-1: Soil Type By Acres in the Planning Area

Soil Type	*Erosion Potential (K factor)*	*Shrink Swell Potential*	*Acres*	*Percent of Planning Area*
Nord fine sandy loam	Low to Moderate (.17 to .37)	Low	19,856	30%
Grangeville sandy loam, drained	Moderate (.32)	Low	16,245	24%
Tagus loam	Moderate (.32 to .37)	Low	12,921	19%
Akers-Akers, saline-Sodic, complex	Moderate (.32 to .37)	Low	8,370	13%
Calgro-Calgro, saline-Sodic, complex	Low to Moderate (.10 to .32)	Low	5,811	9%
Colpien loam	Moderate (.28 to .32)	Moderate	1,192	2%
Exeter loam	Moderate (.32)	Moderate	517	1%
Yettem sandy loam	Moderate (.24)	Low	457	1%
Crosscreek-Kai association	Moderate (.20 to .32)	Moderate	442	1%
Flamen loam	Moderate (.32)	Moderate	414	1%
Riverwash	NA	NA	392	1%
Tujunga loamy sand	Low (.17 to .20)	Low	23	0%
Total			**64,443**	**100%**

Source: USDA Natural Resources Conservation Service, 2012; Dyett & Bhatia, 2012.

Figure 3.7-1:

Erosion Susceptibility and Shrink Swell Potential



Settlement

Settlement is the depression of the bearing soil when a load, such as that of a building or new fill material, is placed upon it. Soils tend to settle at different rates and by varying amounts depending on the load weight, which is referred to as differential settlement. Differential settlement can be a greater hazard than total settlement if there are variations in the thickness of previous and new fills or natural variations in the thickness and compressibility of soils across an area. Settlement commonly occurs as a result of building construction or other large projects that require soil stockpiles. If these areas are comprised of soil stockpiles or other areas of unconsolidated fill materials, they have the potential to respond more adversely to additional load weights as compared to adjacent native soils.

Subsidence

Subsidence is the gradual settling or sinking of the earth's surface with little or no horizontal motion. Subsidence typically occurs in areas that overlie an aquifer where the groundwater level is gradually and consistently decreasing. Additionally, subsidence may also occur in the presence of oil or natural gas extraction. The Kaweah Subbasin that underlies the Planning Area is considered to be in an overdraft condition on an average long-term basis. According to the most recent Urban Water Management Plan (UWMP), groundwater elevations have declined up to 50 feet between 1990 and 2010.[1] While groundwater recharge efforts are in progress, groundwater levels will continue to decline unless recharge is increased.

Seismic Hazards

The Planning Area is in a seismically stable region of the State. While the southern San Joaquin Valley contains some small faults, the closest of these are 30 miles away, and none are known to be active. In comparison to many regions in California, Visalia exhibits relatively little tectonic activity. The major fault systems in the area include the San Andreas Fault, located 75 miles away from Visalia, and the Owens Valley Fault Group, located east of the Sierras and more than 125 miles away from the City (see **Figure 3.7-2**).

The San Andreas is considered to be the fault most likely to be the source of a future major earthquake in California, with potential seismic events of 6.8-8.0 magnitude. The Owens Valley Fault Group has been the source of seismic activity in Tulare County in the past. This fault is estimated to have a potential earthquake magnitude between 6.5 and 8.2. The last major earthquake along this fault was in 1872 and had a magnitude of 8.[2]

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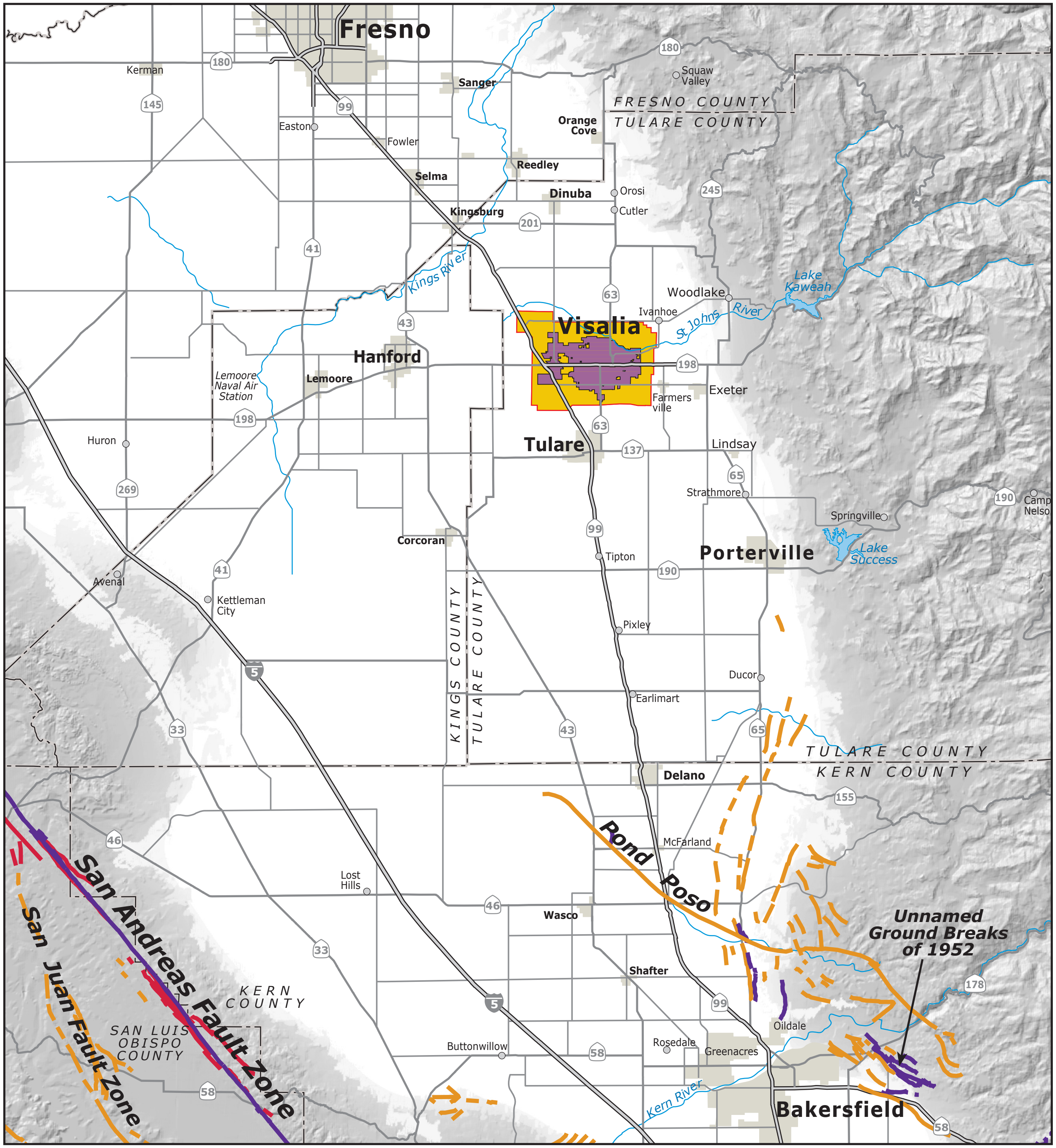
[1] California Water Service Company. *Urban Water Management Plan, Visalia District.* 2010.

[2] Crawford, Multari & Clark Associates for City of Visalia. *Southeast Area Specific Plan EIR.* May, 2010.

Figure 3.7-2:
Regional Faults



Active Fault with Historic (last 200 years) Displacement

Active Fault with Holocene (last 11,000 years) Displacement

Potentially Active Fault with Quaternary (last 1,600,000 years) Displacement

Visalia City Limits

Planning Area

County

Source: Department of Conservation, California Geological Survey, 2005.

Surface Fault Rupture

The magnitude and nature of fault rupture can vary for different faults or even along different strands of the same fault. Surface rupture can damage or collapse buildings, cause severe damage to roads and other paved areas, and cause failure of overhead as well as underground utilities. Future faulting is generally expected along different strands of the same fault.[3] Ground rupture is considered more likely along active faults.

No active or potentially active faults are known to exist within the Planning Area. The closest potentially active fault is located approximately 25 miles southeast of Visalia, but is not known to be active within the last 1.6 million years (see **Figure 3.7-2**). The San Andreas and Owens Valley fault systems would not be expected to cause surface fault rupture in the Planning Area.

Ground Shaking

Ground movement during an earthquake can vary depending on the overall moment magnitude, distance to the fault, focus of earthquake energy, and type of geologic material. As a rule, the greater the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of ground shaking. However, different geologic materials respond differently to earthquake waves. The composition of underlying soils, even those relatively distant from faults, can intensify ground shaking. The Modified Mercalli (MM) intensity scale (see **Table 3.7-2**) is commonly used to measure earthquake effects due to ground shaking. The MM values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X could cause moderate to significant structural damage.[4]

The California Geological Survey and US Geological Survey conducts a Probabilistic Seismic Hazard Analysis based on historic earthquakes, slip rates on major faults and deformation throughout the region and the potential for amplification of seismic waves by near-surface geologic materials. The resulting earthquake shaking potential is used in developing building code design values, estimating future earthquake losses and prioritizing earthquake retrofit. In the Planning Area, low levels of shaking, with less frequency, are expected to damage only weaker masonry buildings. However, very infrequent earthquakes could still cause strong shaking.[5]

Liquefaction

Liquefaction is a phenomenon whereby unconsolidated and/or near-saturated soils lose cohesion as a result of severe vibratory motion. The relatively rapid loss of soil shear strength during strong earthquake shaking results in temporary, fluid-like behavior of the soil. Soil liquefaction causes

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[3] California Geological Survey. *CMDG Note 32.* 1997.

[4] The damage level represents the estimated overall level of damage that will occur for various MM intensity levels. The damage, however, will not be uniform. Some buildings will experience substantially more damage than this overall level, and others will experience substantially less damage. Not all buildings perform identically in an earthquake. The age, material, type, method of construction, size, and shape of a building all affect its performance.

[5] California Geological Survey and US Geological Survey. *Earthquake Shaking Potential for California, Map Sheet 48 Revised 2008.* 2008. Accessed at http://www.conservation.ca.gov/cgs/information/publications/ms/Documents/MS48_revised.pdf

ground failure that can damage roads, pipelines, underground cables, and buildings with shallow foundations. Liquefaction more commonly occurs in loose, saturated materials.

The potential for liquefaction is recognized throughout the San Joaquin Valley where unconsolidated sediments and high water tables coincide. Liquefaction hazards may exist in and around wetland areas and creeks, though soil types are generally too coarse or too high in clay content, and not likely to be subject to sufficient acceleration to cause liquefaction. Detailed geotechnical studies would be necessary to more accurately evaluate and map liquefaction potential.[6]

Table 3.7-2 Modified–Mercalli Intensity Scale (Ground Shaking)

Intensity Value	*Intensity Description*	*Average Peak Acceleration*
I	Not felt except by a very few persons under especially favorable circumstances.	< 0.0017 g
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	< 0.014 g
III	Felt noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly, vibration similar to a passing truck. Duration estimated.	< 0.014 g
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	0.014–0.039 g
V	Felt by nearly everyone, many awakened. Some dishes and windows broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles may be noticed. Pendulum clocks may stop.	0.039–0.092 g
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; and fallen plaster or damaged chimneys. Damage slight.	0.092–0.18 g
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.	0.18–0.34 g
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.	0.34–0.65 g
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.65–1.24 g

[6] ESA for County of Tulare. *Tulare County General Plan Background Report.* December 2007.

Table 3.7-2 Modified–Mercalli Intensity Scale (Ground Shaking)

Intensity Value	*Intensity Description*	*Average Peak Acceleration*
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	> 1.24 g
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 1.24 g
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 1.24 g

g (gravity) = 980 centimeters per second squared. 1.0 g of acceleration is a rate of increase in speed equivalent to a car traveling 328 feet from rest in 4.5 seconds.

Source: ABAG and California Geological Survey, 2003.

Ground Failure

The susceptibility of land sliding/slope failure is dependent on the slope and geology as well as the amount of rainfall, excavation or seismic activities. Land that has experienced sliding in the past is often more slide-prone and more sensitive to both human-induced changes and to earthquakes. Earthquake-induced ground failures are unlikely to occur in the Planning Area because of its relatively stable geologic formation and lack of active faults.

Earthquake-Induced Settlement

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid compaction and settling of subsurface materials (particularly loose, non-compacted, and variable sandy sediments) due to the rearrangement of soil particles during prolonged ground shaking. Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Typically, areas underlain by artificial fills, unconsolidated alluvial sediments, slope wash, and areas with improperly engineered construction fills are susceptible to this type of settlement. During an earthquake, some settlement of soil materials in Visalia may occur.

REGULATORY SETTING

State Regulations

Alquist-Priolo Earthquake Fault Zoning Act (1972)

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act) requires the delineation of zones along active faults in California. The purpose of the Alquist-Priolo Act is to regulate development on or near active fault traces to reduce the hazard of fault rupture; however, surface fault rupture is not necessarily restricted to the area within the Alquist-Priolo Zone. The Alquist-Priolo Act prohibits the location of most structures for human occupancy across active fault traces. Within these zones, cities and counties must regulate certain development, which includes withholding permits until geologic investigations demonstrate that development sites are not threatened by future surface displacement. There are no designated Alquist-Priolo zones in the Planning Area. The risk of surface fault rupture is not necessarily restricted to the area within a Fault Rupture Hazard Zone, as designated under the Alquist-Priolo Act.

Hospital Facilities Seismic Safety Act of 1973

The Alfred E. Alquist Hospital Facilities Seismic Safety Act (HSSA) was passed in 1973 to ensure that hospitals in California conform to high construction standards and are reasonably capable of providing services to the public after a disaster. The HSSA requires the establishment of rigorous seismic design regulations for hospital buildings and requires that new hospitals and additions to hospitals have the capacity, as far as is practical, to remain functional after a major earthquake. State law requires that all existing hospital buildings providing general acute care as licensed under provisions of Section 1250 of the California Health and Safety Code be in compliance with the intent of the HSSA by the year 2030.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act was developed to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. Geotechnical investigations conducted within Seismic Hazard Zones must incorporate standards specified by CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards.[7] The purpose of the Seismic Hazard Mapping Act is to identify where special provisions, beyond those contained in the UBC, are necessary to ensure public safety. This need has not been recognized for the hazard of ground shaking. Design provisions contained in the UBC are believed to be representative of current knowledge and capability in earthquake-resistant design.[8] No portion of Tulare County has been mapped under the Seismic Hazards Zoning Program.

California Building Standards Code

The California Building Standards Code (CBC) has been codified in the California Code of Regulations (CCR) as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the CBC is to establish minimum standards to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction. The 2010 CBC was published on July 4, 2010 and effective January 1, 2011. This is timed with the use of the 2009 IBC in

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[7] California Geological Society (CGS). *Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards*. 1997. 1997.

[8] CGS, 2004.

CA. In addition, the CBC contains necessary California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design, and includes means for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion into building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients which are used to determine a Seismic Design Category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site and ranges from SDC A (very small seismic vulnerability) to SDC E/F (very high seismic vulnerability and near a major fault). Design specifications are then determined according to the SDC.

California Department of Transportation (Caltrans)

Jurisdiction of the California Department of Transportation (Caltrans) includes State and interstate routes within California. Any work within the right-of-way of a federal or State transportation corridor is subject to Caltrans regulations governing allowable actions and modifications to the right-of-way. Caltrans standards incorporate the California Building Code, and contain numerous rules and regulations to protect the public from seismic hazards such as surface fault rupture and ground shaking. In addition, Caltrans standards require that projects be constructed to minimize potential hazards associated with cut and fill operations, grading, slope instability, and expansive or corrosive soils, as described in the Caltrans Highway Design Manual (HDM).

Regional and Local Regulations

City of Visalia Building Code

The City of Visalia has adopted the 2013 California Building Code as the City's building code and ordinance (*Title 15: Buildings and Construction*).

The Subdivision Ordinance requires that a preliminary soils report be provided as part of the application for a tentative subdivision map, unless the city engineer determines that no preliminary analysis is necessary (*Title 16: Subdivisions*).

General Plan Seismic Safety Element

The existing Visalia General Plan incorporates the Seismic Safety Element completed in 1974 by the Five-County Seismic Safety Committee, with participation from the Tulare Council of Governments. The Safety Element determines that ground shaking is the main potential hazard in the southern Central Valley, and the risk of ground shaking in the Visalia area is low. The Element includes a number of policies, calling for the creation of a public relations and education program to build awareness; development of an Earthquake Disaster Plan; consideration of seismic hazards in the environmental impact assessment process; and adoption and enforcement of the Uniform Building Code, among others.

Tulare County Multi-Jurisdictional Hazard Mitigation Plan

A hazard mitigation plan is a formal document that outlays the plans to reduce or eliminate the long-term risk to human life and property from natural or man-made hazards. Visalia participates in the preparation of the Multi-Jurisdictional Local Hazard Mitigation Plan (MJ-LHMP) which covers Tulare County and eleven participating cities. The last MJ-LHMP was prepared in 2011. The plan has been designed to meet four goals; (1) significantly reduce life loss and injuries, (2) minimize damage to structures and property, as well as disruption of essential services and human activities, (3) protect the environment, and (4) promote hazard mitigation as an integrated public policy.

Impact Analysis

SIGNIFICANCE CRITERIA

Implementation of the proposed Visalia General Plan would have a potentially significant adverse impact if it would:

Criterion 1: Increase exposure of people or structures to the risk of property loss, injury, or death involving: rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist or based on other substantial evidence of a known fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides.

Criterion 2: Result in substantial soil erosion or topsoil loss.

Criterion 3: Be located on: a geologic unit or soil that is unstable or that would become unstable as a result of the project; expansive soils (high shrink-swell potential), as defined in Section 1803.5.3 of the 2010 California Building Code; or weak, unconsolidated soils, creating substantial risks to life or property from on- or off-site landslide, lateral spreading, liquefaction, or collapse.

Criterion 4: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

Criterion 5: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

METHODOLOGY AND ASSUMPTIONS

This evaluation reviews applicable regulations and guidelines, and published geologic, soils, and seismic maps and studies to determine the exposure of the planning area to geological and seismic risks. These documents and maps provide broad information on fault locations, estimated ground shaking response, and liquefaction potential. Due to the scale of these maps and programmatic level of project detail provided, this analysis should be used in the most general sense, and does not satisfy the need for subsequent site-specific geologic and soils surveys for individual projects.

IMPACT SUMMARY

Proposed Project Impact	*Mitigation Measure*	*Significance after Mitigation*
Implementation of the proposed General Plan could increase exposure of people or structures to loss, injury, or death involving seismically induced surface rupture, ground shaking, ground failure, liquefaction, or landslides.	None required	Less than significant
Implementation of the proposed General Plan has the potential to result in substantial soil erosion or the loss of topsoil.	None required	Less than significant
Implementation of the proposed General Plan could cause new development to be built on expansive, weak, or unconsolidated soils that would become unstable as a result of development, creating substantial risks to life or property from on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.	None required	Less than significant
Implementation of the proposed General Plan could result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state, or the loss of a locally-important mineral resource recovery site.	None required	Less than significant

IMPACTS AND MITIGATION MEASURES

Impact

3.7-1 Implementation of the proposed General Plan could increase exposure of people or structures to loss, injury, or death involving seismically-induced surface rupture, ground shaking, ground failure, liquefaction, or landslides. (*Less than Significant*)

Visalia is located in a seismically stable region of the State. No active faults are known to exist in the Planning Area; the major, historically active fault systems—the San Andreas Fault and the Owens Valley Fault Group—are located 75 and 125 miles to the west and east, respectively. As a result, the risk of surface rupture is very low. The Planning Area has very little elevation change; therefore, the risk of landslides is minimal. No specific liquefaction hazard areas have been identified in the Planning Area; however the potential for liquefaction is recognized throughout the San Joaquin Valley in locations where the water table is high. Ground shaking is considered the greatest seismic hazard in the Planning Area. Low levels of shaking, with less frequency, would be expected to damage weaker masonry buildings, and very infrequent, large earthquakes could cause strong shaking. Given the distance to major faults, the region is considered to have a relatively low ground shaking hazard.

The continued construction of buildings, overpasses, underpasses, and other structures that meet current building codes would minimize the potential for severe damage and loss of life in the event of earthquake-related ground shaking or ground failure. The purpose of these parameters is to ensure construction of buildings that will resist collapse during an earthquake. These parameters do not protect buildings from all earthquake shaking hazards, but are designed to reduce hazards to a manageable level. In some cases, redevelopment and reinvestment under the proposed General Plan would be expected to reduce vulnerability compared to existing conditions by replacing older, non-conforming structures with ones that are fully compliant with the Building Code. Proposed Plan policies direct the City to strengthen its review criteria with regard to seismic hazards and to improve its emergency response planning and facilities, among other things. Adherence to existing regulations, in addition to the proposed General Plan policies below, would reduce this potential impact to less than significant.

Proposed General Plan Policies that Reduce the Impact

S-P-1 *Work with Caltrans to seismically retrofit or replace local ramps and freeway overpass bridges that are categorized as structurally deficient by Caltrans, are located in high ground shaking areas, and/or are necessary for first responders to use during and/or immediately after a disaster or emergency.

S-P-2 *Seismically retrofit or replace public works and/or emergency response facilities that are necessary during and/or immediately after a disaster or emergency.

S-P-3 *Update the City's Emergency Preparedness Plan to include an Earthquake Disaster Plan, and coordinate procedures with the County Emergency Services.

S-P-4 *Establish a public relations and education program to increase community awareness for emergency preparedness, including "community emergency preparedness teams."

Involving residents and having voluntary programs to help people prepare is the key to an effective program.

S-P-5 *Update subdivision and zoning ordinance review criteria to include seismic considerations.

S-P-6 *Continue to inspect unoccupied existing unreinforced masonry structures and "critical facilities" constructed prior to 1948 and develop condemnation procedures to be included in a dangerous building ordinance.

S-P-7 *Consult with a qualified engineering geologist to periodically review the Safety Element.

Mitigation Measures

None required.

Impact

3.7-2 Implementation of the proposed General Plan has the potential to result in substantial soil erosion or the loss of topsoil. ***(Less than Significant)***

Topsoil refers to the uppermost 6 to 8 inches of soil, which have the highest concentration of organic matter, and where most biological soil activity occurs. Soil erosion occurs when soil is removed by wind and water at a greater rate than it is formed. Soil erosion removes the topsoil first and can continue to transport lower layers.

Overall, implementation of the proposed General Plan would result in construction activities related to development projects that would involve groundbreaking and could lead to increased erosion rates. Increased soil erosion rates, especially for soils with moderate to high erosion potential, can lead to unstable ground surfaces. The potential for erosion is limited by the Planning Area's relatively flat elevation.

Future development and creation of new impervious surfaces also has the potential to contribute to increased stormwater runoff, which could make soil erosion more severe if stormwater is not handled properly. Soil erosion at construction sites can increase sedimentation in nearby streams and drainage channels. However, this potential impact will be minimized through adherence to the General Construction Activity Permit under the National Pollutant Discharge Elimination System (NPDES) program administered by the Central Valley Regional Water Quality Control Board (RWQCB).

All projects exceeding one acre in size are required to comply with the provisions of the Construction General Permit under the RWQCB's NPDES program. Under the terms of the Construction General Permit, dischargers whose projects disturb one or more acres of soil, or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must include a detailed site map(s), including drainage patterns, and identify Best Management Practices (BMPs) that will be used to manage storm water. The SWPPP must contain measures for both the active construction phase and the post-construction phase. SWPPPs must also detail monitoring programs, including a sediment monitoring program if the site discharges directly to a water body listed on the 303(d) ("impaired water bodies") list for sediment. Failure to adequately implement, monitor, or maintain measures outlined in an approved SWPPP results in enforcement action by the RWQCB.

Meanwhile, the City of Visalia has developed a Storm Water Management Program (SWMP)[9], to carry out the requirements of the RWQCB's General Permit for stormwater discharges from small municipal separate storm water systems (MS4s). The SWMP describes plans to handle storm water runoff from increased impervious surfaces as the City grows.

In addition to existing regulations, the proposed General Plan includes the following policies that address erosion potential, further reducing this potential impact to less than significant.

Proposed General Plan Policies that Reduce the Impact

OSC-P-8 Protect, restore and enhance a continuous corridor of native riparian vegetation along Planning Area waterways, including the St. Johns River; Mill, Packwood, and Cameron Creeks; and segments of other creeks and ditches where feasible, in conformance with the Parks and Open Space diagram of this General Plan.

Waterway corridors provide irrigation water for agriculture, recreational opportunities, habitat, and storm drainage. They will provide new links between

[9] City of Visalia. 2005 Storm Water Management Program. Available: http://www.waterboards.ca.gov/water_issues/programs/stormwater/swmp/visalia_swmp.pdf

neighborhoods, parks, and Downtown, and provide a new way of experiencing the City and understanding its natural setting. See also policies in the Parks Location and Design and Trails and Bikeways sections.

OSC-P-13 *In new neighborhoods that include waterways, improvement of the waterway corridor, including preservation and/or enhancement of natural features and development of a continuous waterway trail on at least one side, shall be required.

Figures 6-2 and 6-3 show examples of typical future residential and neighborhood commercial development along waterways. Refined guidelines and cross-sections should ensure flexibility while achieving Plan policies.

OSC-P-28 Require new development to implement measures, as appropriate, to minimize soil erosion related to grading, site preparation, landscaping and construction.

Mitigation Measures

None required.

Impact

3.7-3 Implementation of the proposed General Plan could cause new development to be built on expansive, weak, or unconsolidated soils that would become unstable as a result of development, creating substantial risks to life or property from on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. (*Less than Significant)*

The Planning Area has flat topography and is distant from any delineated Alquist-Priolo Earthquake Fault Zone. Although no specific liquefaction hazard areas have been identified, the potential for liquefaction is recognized throughout the San Joaquin Valley where unconsolidated sediments and high water tables coincide. Subsidence in the Planning Area from groundwater removal may also occur. Inadequate soil and foundation engineering on weak or unconsolidated soils (such as poorly engineered artificial fill) could cause soils and overlying structures to settle unevenly, thereby weakening structural facilities. Low-strength soils subjected to settlement could, over time, cause damage to underground utilities. Structures placed directly on expansive soils could be subject to seasonal shrink-swell effects, causing structural damage and possibly damage to underground utilities. Soils with moderate shrink-swell potential underlie about 2,480 acres in the Planning Area, near the Highway 99/198 interchange; north of the St. Johns River; and near the intersection of Avenue 328 and Road 80. The latter two areas would not be urbanized under the proposed General Plan.

Continued compliance with the Uniform Building Code is critical to assuring liquefaction, subsidence, and differential settlement risks associated with future development are minimized. The Subdivision Ordinance requires a preliminary soils report as part of the application for a tentative subdivision map. If the preliminary soils report indicates the presence of expansive soils, settlement, and potential for subsidence, the City will make recommendation for necessary adjustments to project plans that offset potential soil problems. Adherence to these requirements reduces this impact to a level that is less than significant.

Proposed General Plan Policies that Reduce the Impact

The policies listed under Impact 3.7-1 are incorporated here by reference.

Mitigation Measures

None required.

3.7-4 Implementation of the proposed General Plan could result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state, or the loss of a locally-important mineral resource recovery site. (*Less than Significant)*

Visalia is part of the Central Valley province, one of several geomorphic provinces in California. The area is underlain by marine and marine-derived sediments from the Sierra Nevada. The most economically significant mineral resources in Tulare County are sand, gravel, and crushed stone, used as sources for aggregate (road materials and other construction). The two major sources of aggregate are alluvial deposits (river beds, and floodplains), and hard rock quarries. Consequently, most Tulare County mines are located along rivers at the base of the Sierra foothills.

Surface mining in California is regulated through the Surface Mining and Reclamation Act (SMARA), a State law adopted in 1975 to address the dual goals of protecting the state's need for a continuing supply of mineral resources, while protecting public and environmental health. SMARA requires that all cities incorporate into their general plans mapped mineral resource designations approved by the State Mining and Geology Board. The Visalia Planning Area contains three former sand and gravel mines, but no currently operating mines and no designated Mineral Resource Zones. The absence of important mineral resources in the Study Area and the regulations established under SMARA make this potential impact less than significant.

Mitigation Measures

None required.